

# Highlights

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## Washington SCIENCE TRENDS

PROJECT SNAP: First application tests will be made this year in the Atomic Energy Commission's "SNAP" program for Satellite Nuclear Auxiliary Power. At least one of the proposed units is now in actual operation for demonstration purposes. Other units will be delivered to the AEC for testing and evaluation during the remainder of 1959 and during 1960.

SNAP Units, as their project designation implies, are generally planned as supplementary power sources for electronic equipment in manned and unmanned satellites and space vehicles. They were first ordered in connection with the Air Force "Sentry" reconnaissance satellites but other military and commercial applications are expected.

Here is an up-to-date picture of the SNAP Program:

SNAP I -- is an isotopic power device reportedly employing cerium 144. Prime contractor is The Martin Co. with Thompson-Ramo-Woolridge serving as subcontractor for rotating conversion equipment. Prototype components for SNAP I have already been tested and the complete unit will be tested soon at a special facility at Martin-Baltimore. Fission product fuel is supplied by the Oak Ridge National Laboratory.

SNAP II -- is a small thermal reactor under development by Atomics International with Thompson-Ramo-Woolridge as major subcontractor. It is a heavier and more powerful device and is not expected to be available for testing until 1960.

SNAP III-- calls for thermo-electric device which permits direct conversion of heat to electricity without the use of moving parts. Martin Co. holds the prime contract and is working with four subcontractors on the program. One unit is reportedly in operation and may be unveiled publicly in the next few weeks. Polonium-210 is said to be the fuel for the first fully operating SNAP III unit, which is to be delivered to the AEC in early 1959.

SNAP IV -- was a proposal by Atomics International in connection with a classified Navy program. This project, it is reported, is no longer being actively pursued.

SNAP V -- is a classified program still in the "concept" stage. No contractors have been publicly announced.

Editors Note: As this week's issue of Washington SCIENCE TRENDS went to press the White House, confirming our report, displayed publicly for the first time a working model of a SNAP III unit using Polonium-210 as a power source)

A SPACE INDUSTRY?: The first of a flood of new contracts from the National Aeronautics and Space Administration (NASA) and the Advanced Research Projects Agency (ARPA) are now being announced -- and may create the impression that there is a "space industry" now in existence. Not so, according to NASA Administrator T. Keith Glennan. He points out:

\* "...Space research cannot be considered as the beginning of a substantial industry any time in the next few years. What we are engaged in, for the immediate future, is strictly a research and development activity.

"What this means is that we design, test and operate prototypes, which we may call upon industries...to build for us. We do not propose to follow the arsenal approach to the solution of our problems.

"Neither do we see this as a mass production program, now or for a long-time to come...."

Nevertheless, Glennan is the first to admit that he may not be the best of prophets. He confessed to a Detroit audience last week that he has a tendency to be conservative in outlook -- that at the end of World War II he envisioned "very little popular market" for an engineering advance such as television.

SPACE COSTS: Lower costs per pound of payload are predicted by Homer Joe Stewart, Director of Program Planning and Evaluation for NASA. He estimates that it takes from 1000 to 6000 pounds of takeoff weight to place in orbit each pound of satellites such as the Vanguard, Explorer and the "talking Atlas." However, he believes that when equipment designed specifically for space purposes becomes available a ratio of 40 to one should be readily attainable and a ratio of 25 to one "is consistent with our current state of knowledge."

Designers of future space and missile systems might take these forecasts into account:

"Under these circumstances, the cost of a vehicle to deliver a payload into orbit may be expected to be as low as \$300 per pound. If we consider that the cost of high grade scientific and electronic equipment, which would constitute the major portion of the payloads, as well as the added cost, is of the order of \$100 to \$1000 per pound, the delivery cost does not appear to be at all disproportionate.

"These calculations not only indicate that the costs of a considerably expanded activity in space will not require a proportionate expansion in our budget, but also show that the larger boosters developed for the U.S. military weapons programs have the capacity, if modified, to launch very substantial payloads into space..."

Modifications required for such missions, the NASA official says, include some strengthening of the structure, development of suitably sized upper stage rocket vehicles and guidance and communications equipment tailored to suit the special needs of space missions. With such changes, he estimates, an IRBM has a potential orbital payload in excess of one ton and an ICBM has a potential payload of four to five tons.

Larger equipment, such as the million pound thrust engine now under development, will nevertheless be required for "the very difficult kinds of space operations which we hope to grow up to during the next decade."

## ATOMIC POWER PROGRAMS

Prototype reactors, rather than large-scale power projects, should be emphasized in future Government programs according to a report by the Atomic Energy Commission's Advisory Committee on Reactor Policies and Programs. The Committee defines prototype as a pilot plant designed with the construction of a large plant in mind. It would "preferably" be designed at the same time the larger plant is designed, or later. It would have all of the elements of a full-scale reactor and could be used in the sale of power to reduce costs. However, it would not be an essential part of a power system.

Report of the AEC Committee came as the powerful Joint Committee on Atomic Energy was taking testimony on its own proposals for future atomic power programs. The Report takes on unusual importance because it appears to have won some measure of favor from key committee Democrats who go so far as to judge its overall approach as "reasonable."

Advisory Committee had this to say about the prototype-full scale controversy:

"...The burden of proof at this time is on the proponents of large power plants. We think each such proposal should be examined carefully with respect to the cost to the Government and cost to the consumer. Then the knowledge to be gained should be compared with that which a smaller prototype might furnish and balanced against the difference in costs."

Here, for reference purposes, are the Committee's comments on other controversial phases of the atomic program. It is not unlikely that many of these suggestions will show up in future months as proposed AEC policy:

\* Water Cooled Reactors -- "We believe that the AEC should not furnish any construction funds for the building of more large-scale power reactors of the pressurized or boiling water type. AEC support of research and development should continue, with particular attention to improvements in the various elements affecting fuel-cycle costs..."

\* Breeder Reactors -- "We feel that the development of breeder reactors should be pushed vigorously, since otherwise we might find ourselves faced with a shortage of fissionable material by the year 2000. Successful breeding is the equivalent of multiplying our fuel reserves by a large factor, which could be as high as 50 or 100, and should have a further consequence of lowering costs..."

\* Gas Cooled Reactors -- "The Committee believes that the civilian power program of the United States should include a major effort on gas cooled reactors. The effort of the U.S. should be aimed at producing temperatures of more than 1000°F. This is in line with the present direction of the program."

\* Fluid Fuel Reactors -- "The...fluid fuel systems should be evaluated first as to promise for producing low cost nuclear power and not more than one project supported on the basis of that objective...We see no present basis for the construction of fluid fuel reactors."

(Complete Report available upon request. Write U.S. Atomic Energy Commission, Washington 25, D.C. Att: Information Services, for Report by Ad Hoc Advisory Committee on Reactor Policies and Programs.)



NERVE GAS CHEMOTHERAPY: Studies at the Army Chemical Warfare Laboratories, Edgewood, Md. are reported to be pointing the way toward a more effective treatment for nerve gas poisoning and for accidental poisoning by some types of insecticide. A report to the American Chemical Society states that an oxime compound known as TMB-4 considerably enhances the effectiveness of atropine, the standard antidote. However, no oxime tested has yet shown itself sufficiently potent in small doses, or sufficiently free from toxic or other undesirable side effects.

(Details from American Chemical Society, 2 Park Avenue, N.Y. 16, N.Y.)

RADOME DEVELOPMENT: A radome of fiberglass, described as the world's largest, has been produced for the U.S. Air Force at Goodyear Aircraft, Akron, Ohio. The structure, 68 feet in diameter, is made up of hundreds of panels bolted together in a few basic panel groups. Panels are interchangeable and erection or dis-assembly is said to be possible in approximately 80 hours, using a six-man crew. Goodyear is under contract to produce radomes "well over" 100 feet in diameter for the missile detection network.

MOLYBDENUM FOR MISSILES: Research at the Bureau of Mines Laboratory, Albany, Oreg. has led to the casting of molybdenum, in what is described as a "major metallurgical breakthrough" of importance to space and missile programs. The Bureau reports that the cylindrical casting is the first in the world and researchers are now attempting to improve techniques so that various intricate shapes can be created. It is reported that such developments would provide the missile engineer with a greater flexibility of design and a cheaper way to construct certain vital components which must withstand high temperatures.

The United States is said to have about 90 per cent of the world's known supply of molybdenum -- enough to last about 50 years at the present state of production. Molybdenum is used in steel, in high-temperature alloys, for plates in electronic tubes, lead and grid wires and varied other electrical devices and in heat radiation shields. Molybdenum compounds, the Bureau reports, include catalysts, lubricants, ceramics, pigments, fertilizers, insecticides and chemical reagents.

(Some details available -- See The Checklist)

SYNTHETIC PAIN-KILLER: Research at the National Institutes of Health, Bethesda, Md. has led to the development of a new pain-killing drug said to be many times more powerful than morphine and less addicting and safer than morphine. The drug, known as NIH 7519 is made from derivatives of coal tar and belongs to the benzomorphan series of compounds. Patent rights have been assigned to the U.S. Government. Production of research supplies has been carried out by Smith, Kline and French, Philadelphia. The Government is exploring the possibilities of assigning foreign rights to the World Health Organization.

(Details from Information Office, U.S. Public Health Service, Washington 25, D.C.)

**ENGINEERING EDUCATION:** Reports to the U.S. Office of Education indicate an 11 percent drop in freshman engineering enrollment in colleges and universities at the beginning of this school year. The decrease follows a steady seven year gain in the number of new engineering students. Total undergraduate enrollment was also off. The 1957 figure was 268,761, some 4.4 percent above the 1958 total. There was a small increase in the number of engineering graduate students. However, the overall decline in engineering enrollments was viewed as particularly disturbing because total enrollment in institutions of higher education for all subjects is higher -- by 6.2 per cent.

(Details from Information Office, U.S. Department of Health, Education and Welfare, Office of Education, Washington 25, D.C.)

**SEMICONDUCTOR RESEARCH:** Studies for the Air Force performed by General Electric Co., Syracuse, N.Y. are connected with the development of silicon power transistors capable of delivering large power at relatively high temperatures. Research demonstrated that such transistors can be fabricated by diffusing impurities in from the surface to form the base and emitter regions.

(Details from OTS, U.S. Department of Commerce. Order PB151201. 136 Pages. \$3)

**FRACTURE STRENGTH RESEARCH:** Studies at the Naval Research Laboratory are designed to develop methods for duplicating strain and stress conditions in laboratory measurements of fracture strength. Observations suggest that it may be possible to predict which fracture mode will occur. The work is said to be of importance in the analysis of such problems as the fracture of pressurized-fuselage commercial jet aircraft, bursting of large steam turbine-generator rotors, structural vulnerability of combat airplanes, shattering of transparent plastic canopies, and crack propagation in rocket-engine vessels.

(Studies by Mechanics Division, Ballistics Branch, U.S. Naval Research Laboratory, Washington 25, D.C.)

**ELECTRONICS PROCUREMENT:** Defense Department has spent nearly \$24 billion for electronics since Fiscal Year 1951. Electronics Industries Association reports that purchases were down slightly in the first quarter of this Fiscal Year (July-August-September 1958) -- to \$958 million. This was below the \$1.187 billion of the previous quarter but better than the \$926 million spent by the military for electronics in the first quarter of Fiscal Year 1958.

**ATOMIC PARTICLE PHOTOGRAPHS:** Research into combat surveillance systems for the Army and Office of Naval Research has led to the development of a system said to make possible the photographing of the light from the path of a single electron. The light, produced along the trail of an electron passing through a scintillating crystal, must be intensified 100,000 times to be picked up by the most sensitive photographic film. Physicists working under Government contract at the University of Michigan, Ann Arbor, expect their new device, called a luminescent chamber, to have important scientific value in the study of high energy nuclear physics. Intensification is achieved with specially developed electron "image" tubes, each of which intensify the light and then focus it on the next tube with lenses. The researchers suggest that parts of their new device, coupled to a TV camera, could be used in satellites by astronomers to obtain pictures of distant stars or galaxies.

### THE CHECKLIST

- ( ) Agricultural Research; a handbook which provides a generalized picture of the U.S. Department of Agriculture's \$84 million research program. Includes material on organization, coordination, nature of the programs and location of facilities. 94 pages. 50 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Publication No. A 1.38:779)
- ( ) Molybdenum Castings; a brief report on a "major metallurgical breakthrough" said to be of importance to space and missile programs. (Write Information Office, U.S. Department of Interior for Release PN 48352, Jan. 15, 1959)
- ( ) Gas Turbines; a reference book on gas turbine engine installation written for marine service. Manual indicates various characteristics required for preliminary design and installation layouts of propulsion, fog generator, air supply, pump and generator drive units. 123 pages. \$1. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Publication No. D 211.2:G 21)
- ( ) Electronic Cooling; a reference volume prepared under the sponsorship of the Department of the Navy, Bureau of Ships, to aid electronic engineers in the thermal design of reliable electronic equipment. The manual stresses forced air cooling methods. 220 pages. \$2. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Publication No. D 211.6/2 E1 2)
- ( ) Vibration Manual; the second edition of a manual for engineers prepared by the U.S. Navy. Publication contains formulas said to be useful to design engineers in minimizing vibration difficulties. 32 pages. \$1. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Publication PB 131785)
- ( ) Beryllium Facilities, a summary prepared by the New York Operations Office of the Atomic Energy Commission on ten years of experience in the field of health protection in beryllium facilities. 58 pages. \$1.75. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Publication HASL-36)
- ( ) Radioisotopes; a selected list of references covering the use of radiosotopes in medicine and human physiology. 124 pages. \$2.75. (Write OTS, U.S. Department of Commerce for Publication TID -3514)
- ( ) Radioisotope Experiments; a new revision of a government guide to 20 laboratory experiments selected because they could be introduced into high school classes in biology, chemistry and physics. 59 pages. 25 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Publication No. Y3.At 7:2 R11/18/958)
- ( ) Titanium Alloys; a Government report on the chemical and galvanic corrosion properties of titanium alloys. Results of tests conducted in synthetic ocean water, tap water and a number of chemical solutions. 27 pages. Free. (Write Publications Distribution Section, U.S. Bureau of Mines for Publication No. 5423)
- ( ) Diatomite Mining Hazards; a Government study to determine the health hazards associated with the mining and processing of diatomite. Reference is made particularly to the problem of pneumoconiosis. 96 Pates. 55 cents. (Write Superintendent of Documents, Government Printing Office, for Publication No. FS 2.2:P 74/2)

